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W ADAMS PAPERS

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BULLETIN
OF THE
PUBLIC MUSEUM OF THE CITY OF MILWAUKEE

Vol. 10, No. 4, Pp. 375-400, Pls. 71-73

March 4, 1932

Exceptional Prehistoric Copper
Implements

By
George A. West

MILWAUKEE, WIS., U. S. A.
Published by Order of The Board of Trustees

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Printed by the
CANNON PRINTING COMPANY
Milwaukee, Wis.

Engravings by the
SCHROEDER ENGRAVING COMPANY
Milwaukee, Wis.

Exceptional Prehistoric Copper Implements

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Both the groove and the broken end are of a dark mahogany color in contrast with the remainder of the instrument, which is heavily coated with verdigris and contains numerous pits and ridges in relief, the result of erosion as heretofore mentioned.

The story of this object seems to be that the metal was obtained, in the then usual way, from the mines of Lake Superior, transported with all the attending hardships, to some village site in eastern Wisconsin, fabricated and used here; then lost and after a long period of time recovered by some later Indian who re-worked it and put it to a use for which it was not originally intended. After a generation or more, it was again lost and remained undisturbed long enough for the accumulation of a foot of soil above it. White man unearthed it in an age when its usefulness as an implement had ceased but its value as a record of the past is inestimable.

AN INTERESTING EXAMPLE OF AN ABORIGINAL COPPER HARPOON

This implement, shown in Plate 73, Fig. 5, is interesting because of the unusual length of its tang, it being longer than any that has come to the writer's notice. This harpoon was found on the surface by Mr. Ivan Nielson while mowing hay. It stood in a perpendicular position with about half its length above the surface. Where the sickle struck the implement is evidenced by a deep cut in the copper.

This rare specimen has found a home in the finest private collection of prehistoric artifacts in this state, owned by Mr. Joseph Ringeisen of Milwaukee.

This object is of the long-tanged type, twelve and three-eighths inches over all, circular in cross section, tapering to a point at each extremity. Its greatest thickness is five-sixteenths of an inch. Its single barb is located about three and one-quarter inches from its point. Its weight is about four ounces. It is heavily coated with verdigris. The softer parts of the metal are eroded away to a considerable extent but otherwise it is in a good state of preservation.

This type of harpoon was doubtless used for the spearing of sturgeon, muskalonge and other large Wisconsin fish.

Prehistoric copper harpoons are rarely found in this State, not over two dozen of the various types combined having been secured here. The next in length to the one above described was collected by the late Mr. W. H. Ellsworth, about thirty years ago. This specimen was ten and three-fourths inches in length and carried a single barb. Two examples of this type are in the collection of the State Historical Museum at Madison, Wisconsin. The larger of these is nine and seven-eighths inches long and the other eight and five-sixteenths inches in length. In the Logan Museum, Beloit, are two specimens: one, eight and three-fourths inches long and the other a trifle shorter. In the J. P. Schumacher collection, Neville Public Museum at Green Bay, Wisconsin, is a harpoon of this class having two barbs.¹⁶³

AN UNUSUAL COPPER KNIFE

This remarkable specimen,¹⁶⁴ shown in Plate 72, Fig. 2, was found on a farm near Elroy, Wisconsin. It is a knife-shaped implement, twelve and three-fourths inches in total length. At eleven inches from its tip, its tang end curves upward and parallels the remainder of the tang for one and one-half inches and at a distance of half an inch from the same. The curve is square in shape, evidently having been formed over some square-faced object. The maximum width of the blade, at about two inches from where the tang commences, is one and one-half inches. From its widest part the blade gradually narrows to a rounded point. The greatest thickness of the object is one-eighth of an inch. Its right side is perfectly flat while the opposite side is somewhat convex. Its back is straight and rounded. Its cutting edge was formed by a concave bevel on its left side, extending back from one-fourth to three-eighths of an inch, gradually narrowing as the point is approached. All parts of the specimen are well coated with verdigris and carry other evidences of age.

The turning back of the tang was most likely done in order to give more stability to the handle. Its handle was doubtless made of two pieces of wood or bone, provided with excavations to receive the tang and then wound about with green hide.

¹⁶³This series, Vol. 10, No. 1, p. 99.

¹⁶⁴A description of this knife has been published by W. C. McKern in the Wisconsin Archeologist, April 1931, pp. 111-113.

Another specimen with the end of its tang curved upward and extending for some distance toward the blade, is in the collection of the Milwaukee Public Museum.¹⁶⁵

A SPATULATE IMPLEMENT

This unusual implement was found on the farm of Mr. Robert Last, in Winnebago County, Wisconsin, and is now in the collection of the Oshkosh Public Museum.

While it is classified with the so-called spatulas, it may have been put to a very different use or to a variety of uses. This object, shown in Plate 72, Fig. 4, is six and one-eighth inches in length, perfectly flat on its right side with a long bevel toward its cutting edge on its left. Its cutting edge is at its base and worked so thin that much of it has disappeared as the result of erosion. Its back is practically straight with its lower part beaten out to a width of two and three-fourths inches with a very keen cutting edge. The upper part of the object is in the form of a tang with a thickness, a third of the way from its point, of five-sixteenths of an inch. This tang, if wound about with rawhide, would make a very satisfactory handle.

My conclusion is that this implement was used as a knife for cutting tanned buckskin or other skins, and in making clothes and ornaments. The tanners of today use curved-bladed knives in cutting leather. This form seems to be more practical than were its blade carried to both sides, as better vision of the work is given, especially in following a line. This object is heavily coated with verdigris and the softer parts greatly eroded, leaving the harder parts in high relief.

AN EXCEPTIONAL COPPER KNIFE-LIKE IMPLEMENT

This unusual specimen, shown in Plate 72, Fig. 3, is the largest knife-like implement so far reported from Wisconsin. It is mentioned in the writer's earlier paper on copper,¹⁶⁶ but at the writing of that paper its examination had not been possible.

A recent study of this unique specimen seems to justify a detailed description of it.

¹⁶⁵West, Geo. A., this series, Vol. 10, No. 1, Plate XXII, Fig. 2.

¹⁶⁶Op. Cit., No. 1, p. 78.

This implement is seventeen and one-half inches in length from tip to tip. Its blade is eleven and one-eighth inches long. An interesting feature of the specimen is the great length of its tang, which measures six and three-eighths inches. Its maximum thickness is near the small end of the tang where it measures one-fourth of an inch. Fully one-half of an inch has recently been broken from the point of the blade, which, if intact, would make the object fully eighteen inches in length. Its rounded back has been recently somewhat mutilated by hammering.

Another interesting feature of the specimen is that it is perfectly flat on its right side while its left contains a ridge the whole length of the blade and along its center, that slopes toward and to its cutting edge as well as to its back. Such a ridge is unusual in copper knives and was doubtless intended for the strengthening of the blade rather than for ornamentation. Its back is perfectly straight and its tang so long and strong that if wound with rawhide it would make a serviceable handle. It could have been used as a knife or blade weapon.

It is also possible that the object was set into the end of a long handle and served the purpose of a pike or spear.

This specimen was found in Winnebago County, Wisconsin, and is in the J. B. Pickett collection, Oshkosh Public Museum.

AN ADZ-LIKE IMPLEMENT

This remarkable aboriginal copper object, shown in Plate 71, was found on an Indian village site on the Archibald Day farm, Section 5, Township 23, Range 2, West, Clark County, Wisconsin, by Mr. W. H. Lowry, July 5, 1887. It was secured by Mr. M. F. Satterlee and donated to the State Historical Museum, Madison, Wisconsin, where it is now on exhibition.¹⁶⁷

This object is fourteen and five-eighths inches in length. Its width at the smaller end is two inches; at cutting edge, five and one-eighth inches; and thickness at its middle, three-eighths of an inch. It weighs four and three-fourths pounds. The cutting edge is slightly convex with rounded corners and widened by the curving outward of the sides of the implement. From the point where the curve commences, about two

¹⁶⁷This information and photo were furnished by Mr. Charles E. Brown, Director, State Historical Museum, Madison.

inches from the cutting edge, the blade gradually narrows toward the smaller extremity, which is square in section and one-quarter of an inch in thickness. At seven and three-eighths inches from the cutting edge the object curves back toward the cutting edge, which bend appears to have been originally given to it by its Indian fabricator. An object with this return of its narrower part would provide a means for the attachment of a handle. Its beautiful patinated surface indicates considerable age.

While this object is labeled "Ceremonial Adz," perhaps because of its unusual size and weight, it differs slightly from the copper adzes found here in not having the cutting edge beveled from the inner side only. The cutting edge of this implement appears to have been formed without the pretense of a bevel. The object of the bevel in copper adzes was evidently to permit the cutting edge to reach the wood or other material being worked before the body of the implement touched it.

It might have satisfied the Indian of its age as a ceremonial, but more likely it was used as a hoe or grub axe in clearing land for agricultural purposes.

The fact remains that it is unique, a most interesting specimen, and may have been put to many unsuspected uses.

AN UNCLASSIFIED IMPLEMENT

This unusual aboriginal copper object was found on the shore of Lake Koshkonong, Wisconsin, and is now owned by Mr. John Robbins of Fort Atkinson, Wisconsin. The illustration, Plate 73, Fig. 3, scarcely does it justice. It is three and five-eighths inches long, square in section, and five-eighths of an inch thick at its widest part, tapering toward its extremities. About midway of the object starts a quick bend, that appears intentional, for half an inch or more, the remainder of the implement continuing at the same angle as that of the opposite end. The shorter portion is somewhat narrower than the other part which would suggest its use as a handle.

The longer part of the object, from its widest extremity, tapers to about an eighth of an inch square, with the end rounded as if from use. The shorter end, that suggests a tang or handle, is too short and heavy for either of such uses. It cannot be held in the hand, in its

present condition, for any purpose that might require leverage or force.

The specimen, in addition to the decided bend above described, is curved or twisted, thus making the use for which it was designed a mystery. It has been suggested that it was intended as a flint chipping implement. This may be possible but quite improbable. That may have been one of the uses to which it was put, as the Indian, possessing but few tools, naturally put them to a variety of uses.

This object is well coated with verdigris and its softer portions considerably eroded, leaving the compact parts in relief. The object is unique and the only one of its kind that has come to the writer's notice.

GROOVED FISH-HOOKS

Plate 73, Fig. 1, shows a type of fish-hook that is interesting and rare. It is one and one-fourth inches long and has a groove around the shank near its top. The object of this groove was doubtless the attachment of a line.

This specimen was found at the junction of the Wolf and Fox rivers, Winnebago County, Wisconsin, and is now in the collection of the Oshkosh Public Museum.

A similar one is in the collection of Mr. Joseph Ringeisen, of Milwaukee, and a third in the exhibit of the State Historical Museum at Madison. These are the only examples of this type that have come to the writer's notice out of a thousand or more copper fish-hooks examined.

Thus it is evident that but a small number of these objects, so far found, are provided with a groove near the end of the shank. About an equal number contain an eye, and an occasional one has the extremity of its shank split for a short distance and thus widened. A few are recovered with about an eighth of an inch of the end of the shank turned at nearly right angles to it. Any of these four types would, as a matter of course, give to the attachment of the line added security. It is generally known to collectors and students that, as a rule, the aboriginal copper fish-hooks of the Great Lakes region have straight shanks and that the attachment of the line was probably done in much the same manner as that employed by the white man today. A little pitch and a thin strip of sinew answering the same purpose then as silk

and shellac do now. These, like other aboriginal fish-hooks, were not provided with a barb as the Indian of the past was not a surface fisherman, but let his bait sink deep, allowing the fish to swallow the bait, thus making the barb unnecessary.

Several fish-hooks of this type, but made of bone, were on the Baum village site, Ross county, Ohio.¹⁶⁸

A POSSIBLE SURGICAL INSTRUMENT

Plate 73, Fig. 4, shows an unusual implement from Waupaca County, Wisconsin, seven inches long, square in cross section, one-fourth of an inch in thickness at its middle and tapering toward its extremities. One of its ends terminates in a sharp, slightly curved point and the other is provided with a curved end drawn out into a short, sharp blade or cutting edge.

The object much resembles a certain surgical instrument of today and could well have been used in operating on abscesses and other infections.

AN INTERESTING COPPER CRESCENT

Plate 73, Fig. 2, shows an interesting specimen found in Waupaca County, Wisconsin, in 1928, at the same time and place as was the object just described. Its total length is six inches, width of blade, five and one-eighth inches, by one and one-fourth inches. The length of the shank is four and three-fourths inches. Its width is one and one-half inches. Its shank is square in section with rounded corners. Its prongs are joined at the top by hammering and annealing.

The interesting feature of this object is the fact that one of its prongs had been broken from the blade and repaired. The mending was done by lengthening or drawing out the broken end of the prong by hammering, the blade thinned down and extended upward and perforated by use of a punch. The hole thus made was certainly punched out as the copper around it is considerably extended on one side with no indications of drilling. This clearly indicates the use of the punch

¹⁶⁸Mills, Wm. C., *Exploration of the Baum Village Site, Ohio Naturalist*, Vol. I, pp. 4-8, 1903.

by the red man. The repair was completed by inserting the extended end of the prong through the perforation and bending it upward. While the repair work was effective, it was crude in comparison with that of the original fabricator.

A study of this object leads one to speculate as to its past. Was it used for ceremonial purposes, passing from one generation to another and being highly treasured, or was it merely a knife or implement of utility which as a matter of economy was considered worth repairing?

USE OF IMPLEMENTS

Of the great variety of aboriginal artifacts recovered in Wisconsin, many are classified and named from their shape. Others were placed in certain classes from the uses, we believe, to which they were put, and given names that are misleading. For instance, many of the so-called spear and arrow points were doubtless used as knives. Ornaments and many other of the artifacts are under the correct classification, as their shapes indicate with certainty the use to which they were put. The fact remains that our red brother was possessed of the same amount of ingenuity we have and used the tools at hand for a great variety of purposes. He did this far more than white man does, as his assortment of implements was limited. It is, however, best not to attempt a change in classification, although, in view of our present knowledge, improvement could be made in this respect.

EROSION OF PREHISTORIC COPPER IMPLEMENTS

The tempering of prehistoric copper implements is a myth. Their fabricators knew nothing of the smelting of metals. Although some of their artifacts have been found showing conclusively that they were made of two or more thin pieces of copper that were heated sufficiently, during fabrication, to cause them to firmly adhere. To properly anneal copper about 300° C. is required, which tends to purify the metal. It was believed by Dr. Hoy, a scientist of note, who lived at Racine, Wisconsin, about forty years ago, that in some instances copper implements were swedged into shape, and he suggests that "a matrix was

excavated in stone into which the rudely fashioned copper was placed, and then by repeated blows the article was made to assume the exact shape of the mould."¹⁶⁹ This conclusion, however, has not been borne out by the finding of such moulds.

The prevailing belief now is that the process of manufacturing objects, by the red man from the native copper was by heating, dipping in water and pounding. Heating was found necessary as copper in its natural state is refractory and will scale and break when worked to a thin edge. Fire treatment, such as the Indian practiced, with dipping, softened the copper, making it more ductile and responsive to blows by the stone hammer. In fabricating an object of copper the heating and dipping process had to be repeated frequently. As copper melts at not less than 2,200 degrees of heat, a wood fire in the open, which the ancient artisan doubtless used, could not have furnished sufficient heat to have melted the metal or properly annealed it.

The age of a copper object is usually estimated by collectors from the amount of erosion and corrosion it shows. If it is considerably pitted and well coated with verdigris, it is considered old. This conclusion is not necessarily correct as the mode of its manufacture, the soil conditions in which it was found and several other factors are responsible and must be considered in estimating its relative age.

Half a century ago, while plowing or breaking a piece of virgin soil or prairie land on my father's farm at Raymond, Racine County, Wisconsin, the plow turned up two copper objects that were lying side by side at a depth of about eight inches. One was a small spear-head, finely shaped, and the other a piece of native copper showing only a number of hammer marks. The spear-head was deeply pitted and furrowed by erosion, yet its point was but slightly affected. The companion piece, which was nearly square in section, without point or cutting edge, showed but little signs of dissolution.

About seven years ago I obtained a piece of native copper from the glacial drift, cut away its exterior, and from one-half of it fabricated a small copper knife, employing the method used by the Indian of heating, dipping and hammering. This knife and the unworked piece of copper were at once buried by me under the sod in my back yard, where they remained undisturbed until the present summer.

¹⁶⁹Hoy, Dr. P. R., *Who Built the Mounds*, Times Pbl. Co., Racine, Wis., p. 5. 1886.

Although the period of time that they had lain in the soil was short, the knife showed the results of corrosion to a far greater extent than did the unworked piece.

An examination by me of hundreds of prehistoric copper mines on Isle Royale disclosed the fact that the outcrops of copper, both above and below the soil as well as of many fragments left by the ancient miners on the dumps, were not eroded to as great an extent as are the fabricated implements made from the products of these mines. The same can be said of the copper nuggets that are found in the glacial drift of Wisconsin, which have been pounded and scraped in their long ride in the ice.

Believing that archeologists will appreciate an explanation of the phenomenon of erosion as it relates to prehistoric copper artifacts, which grace the shelves of the museums of this country as well as the cabinets of many private collectors, the writer has sought an explanation from a number of our best authorities on the subject and takes pleasure in quoting from as many of their recent letters as space will permit. I must say that a number of replies to my inquiries were admissions that the matter had not received consideration by the writers. A few, however, were able to furnish information of value on the subject.

Mr. Roy O. McDuffie, Assistant Professor of Metallurgy of the University of Cincinnati, recently wrote.¹⁷⁰

"It is generally recognized that the rate of corrosion of cold worked metals in acids or other corrosive solutions is greater than that of metals in the annealed or unstrained condition. This is true of all metals, and is by no means limited to copper. Thus brass cartridge cases must be given at least a low temperature anneal after they leave the final forming die, or atmospheric corrosion will set in to such an extent that cracking will result. A cold rolled steel will dissolve more rapidly in dilute sulphuric acid than the same steel in the cast or annealed condition. A cold rolled aluminum sheet will go to pieces rapidly in corrosive waters which would have but little effect on an annealed sheet.

"We believe that when metals are cold worked the crystal lattice is so distorted that the atoms of the metal are less firmly held and, therefore, pass into solution more readily. I believe you will find that

¹⁷⁰Personal communication, 1931.

if the ancient copper implements are thoroughly annealed so that the strains are removed, they will be as resistant to corrosion as the surface copper."

Mr. Maxson, Sales Engineer of Mining Machinery Division of Allis-Chalmers Manufacturing Company, Milwaukee, writes:¹⁷¹

"Differential erosion of native copper, fire refined copper, or electrolytic copper might conceivably take place, depending upon the eutectic structure of the metal. In modern copper metallurgy, attempts are made to reduce the copper oxide and sulphide content in the copper to a minimum, but even with the most careful regulation of furnace conditions, this is rather difficult of attainment.

"Presumably, the heating and quenching given to copper by the Indians resulted in some grain growth and development of oxide crystals along the grain boundaries. These oxide crystals would serve as ready points for attack of the metal by humic acids or weak inorganic acids when the implements were buried in the soil.

"There is some possibility of refining the grain of copper by pounding, although such grain refinement should scarcely be a determining factor in the rate of erosion."

Mr. W. J. Fairbairn, Secretary of the National Metal Trades Association, who resides at Milwaukee and with whom I have frequently discussed the subject of erosion of metals, advises as follows:¹⁷²

"In the discussion we have had relative to the condition of copper implements shaped by the early inhabitants of this country which have been unearthed in recent years there has been brought out some peculiar conditions that appear difficult of analysis.

"We assume the simplest and most natural method is the best to follow in analyzing their peculiarities.

"Copper nuggets of almost pure copper are naturally soft. Beating with a hammer will harden them even to the point of brittleness, this process will also refine the metal by forcing out any foreign matter, especially where the metal has been reduced to a fine edge, as a knife or spear point, the main body of metal cannot be beaten as hard as the edges because of its bulk and the resilience of the softer center.

¹⁷¹Personal communication, 1931.

¹⁷²Personal communication, 1931.

"The instrument shaped by repeated annealing and careful hammering is dug up after centuries of time, it is eroded from the physical action of earth and water and corroded by the chemical action of acids contained in the soil, this action will be great or small in proportion to the movement and chemical action of the soil in which it lies and the purity of the metal of which it was made.

"The drawing out of a lump of copper by hammering naturally forms a stratification in the direction of the drawing which accounts for the apparent pitting of the metal lengthwise.

"The edges and occasional streaks in the body refined to a high degree by long, careful pounding resists the action of the elements while other parts are attacked and eaten away.

"To draw out with a hammer and anvil of stone, such instruments as you have shown me, must have taken a great amount of time and patience coupled with considerable skill and in case of the finer instruments the hand of an artist was undoubtedly present.

"I have attempted to give you a picture of these relics as they appeal to me from a practical viewpoint."

A recent letter to the writer from Dr. Curtis L. Wilson, Professor of Metallurgy, The University of Montana School of Mines and State Bureau of Mines and Geology, Butte, Montana, says:

"I was very much interested in your letter of August 15, and believe that I can answer your first and third questions satisfactorily. The second question would be rather difficult to answer without seeing the corroded specimens themselves.

"Copper implements of prehistoric times show greater corrosion than do outcrops and nuggets because the implements have been fashioned by cold working. It is undoubtedly true that such working was started on the red hot metal, but the final shaping must have been done by hammering the cold piece. In my research work in Germany I have shown that cold work on copper produces a less noble potential; in other words, the metal in its hard, cold worked state is less noble electrochemically than in its soft, annealed state, and therefore goes into solution faster. A galvanic cell made up of a hard piece of copper and a soft piece is the negative pole, sending positive ions of copper into solution. (*Zeitschrift fur anorganische und allgemeine Chemie*, Vol. 173, page 159, 1928.) Now a copper implement which has been fashioned

by hammering is a series of such cells; at the spots where the hammer fell the metal is hard and more soluble electro-chemically, while the adjacent areas are soft (or perhaps softer than other hammered areas) and are therefore the positive poles. Had the implements been thoroughly annealed after shaping, the erosion would not have been so marked. A similar phenomenon in modern times is the season cracking of brass, produced by imperfectly annealing the hammered or rolled material.

"Regarding the longitudinal portions of metal standing out in bold relief after corrosion, I can best refer you to the work done by one of my colleagues in Germany (G. Tammann and M. Straumann, *Zeitschrift für Metallkunde*, Vol. 19, page 184, 1928). Straumann, working with Tammann, took a number of coins, which as you know, are cold stamped, and he polished these coins so that the surface was bright and smooth. Then he hung them in an electrolytic cell and etched them with a weak acid in the electrolyte. After a few hours of etching, the original designs on the coin began to appear, and were easily discernible. The same thing happens with implements about which you are writing. They have been subjected to some kind of working, and the effects of this working are by no means superficial, but extend to quite a depth. Although the surface may appear homogeneous, the crystal orientation is not uniform, and corrosion, which is after all only a slow etching, brings out the worked portions in strong relief.

"I am afraid that I can not offer an entirely satisfactory explanation of your statement that the thinly hammered edges and points are corroded less than the thicker parts of the object. It may be that after shaping the objects were annealed more rapidly and more thoroughly than the thicker parts. Being thus in the soft, annealed state, they would form the positive poles of galvanic cells when the objects came in contact with moisture, and would hasten the corrosion of the thicker, less thoroughly annealed parts of the metal."

CONCLUSIONS

After a study of the 1925 edition of "Physical Metallography" by Prof. Dr. Ing. Ehr. E. Heyn, a leading authority on the subject, translated from the German and somewhat argumented by Marcus A. Gross-

man, S. B. Metallurgical Engineer, United Alloy Steel Corporation, and after due consideration of the reports of other eminent authorities quoted in this paper, I am led to the following conclusions in regard to the erosion of pre-historic objects of copper so commonly found in Wisconsin and neighboring states:

That copper in its natural state is refractory and breaks and scales when pounded to a thin edge without treatment of some kind.

That erosion of any kind attacks its softer parts first.

That native copper can be softened and made malleable by heating and dipping in water.

That beating in the process of fabrication, tended to refine the metal and add to its hardness by the compression of its crystal lattice structure. This conclusion appears to be borne out from the fact that the folds of the metal, cutting edges and sharp points of these ancient implements, which naturally received the greatest number of blows while being shaped, invariably show the strongest resistance to erosion.

It seems clear that native copper, when submitted to the heating and dipping process, used by the Indian artisan in making implements, or other objects of copper, amounted practically to "cold working" and robbed the metal of considerable of its resistance to dissolution. This may account for far greater evidences of erosion on fabricated objects of copper recovered from the soil than is shown by native outcrops and nuggets from the drift.

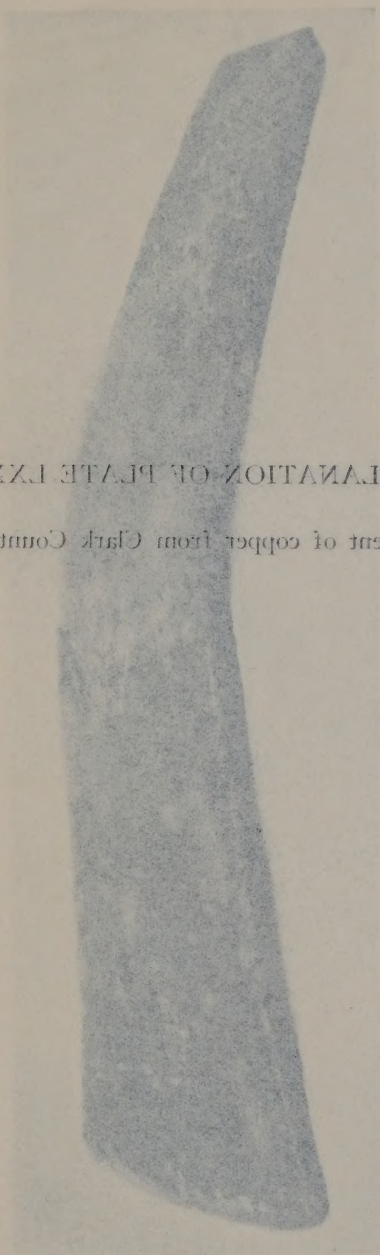
Without attack by some destroying agent, erosion would not take place. Nature's greatest carvers are the winds, rushing waters and devastating frosts. Hidden in the soil are many corrosive elements. Gases from the earth and air are ever active. Each of these various agencies is responsible to a greater or less degree for the gradual destruction of prehistoric copper implements by erosion.

Electrolysis and possibly the slow process, running through centuries, to which the objects under consideration have been subjected, may have played an important part in their oxydization not shown by laboratory tests.

Through the X-Ray, considerable advance in knowledge on the subject under consideration has been made in recent years, but much is yet to be learned.

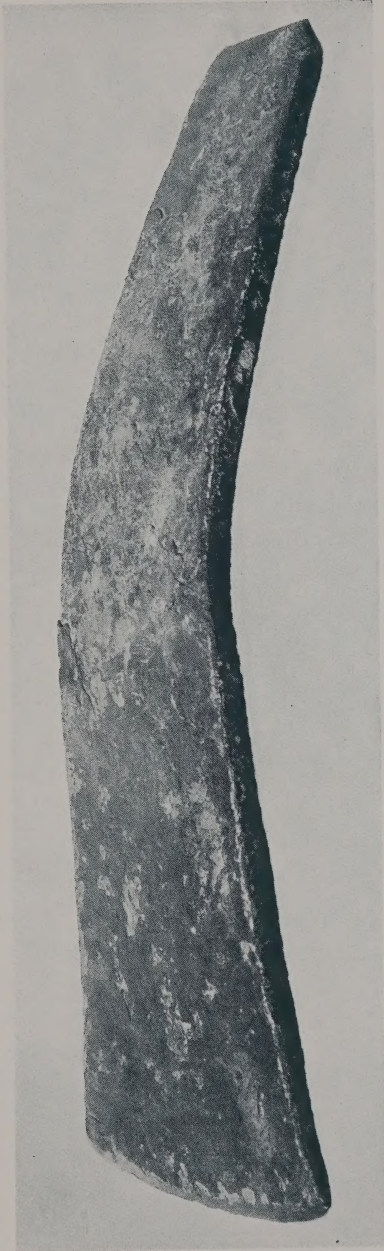
EXPLANATION OF PLATE LXXI.

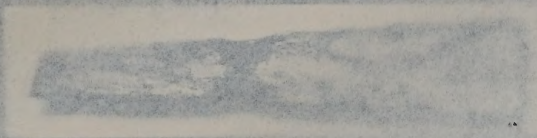
An adze-like implement of copper from Clark County, Wisconsin.



EXPLANATION OF PLATE LXXI.

An adz-like implement of copper from Clark County, Wisconsin.





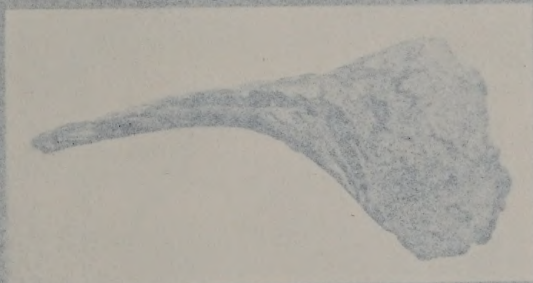
EXPLANATION OF PLATE LXXII.

Figure 1. A re-worked copper implement from Greenville, Wisconsin. Neg. No. 408733.

Figure 2. An unusual copper knife from Elroy, Wisconsin. Neg. No. 70387.

Figure 3. An exceptional knife-like copper implement from Lake Koshkonong, Wisconsin. Neg. No. 70389.

Figure 4. A spatulate copper implement from Winnebago County, Wisconsin. Neg. No. 407925.

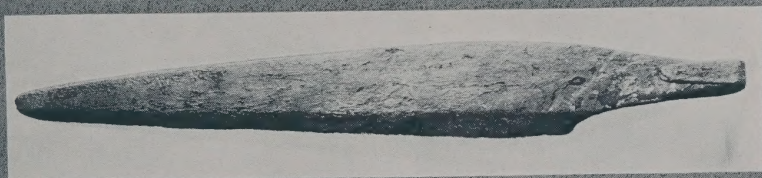


EXPLANATION OF PLATE LXXII.

- Figure 1. A re-worked copper implement from Granville, Wisconsin. Neg. No. 408733.
- Figure 2. An unusual copper knife from Elroy, Wisconsin. Neg. No. 70387.
- Figure 3. An exceptional knife-like copper implement from Lake Koshkonong, Wisconsin. Neg. No. 70389.
- Figure 4. A spatulate copper implement from Winnebago County, Wisconsin. Neg. No. 407932.



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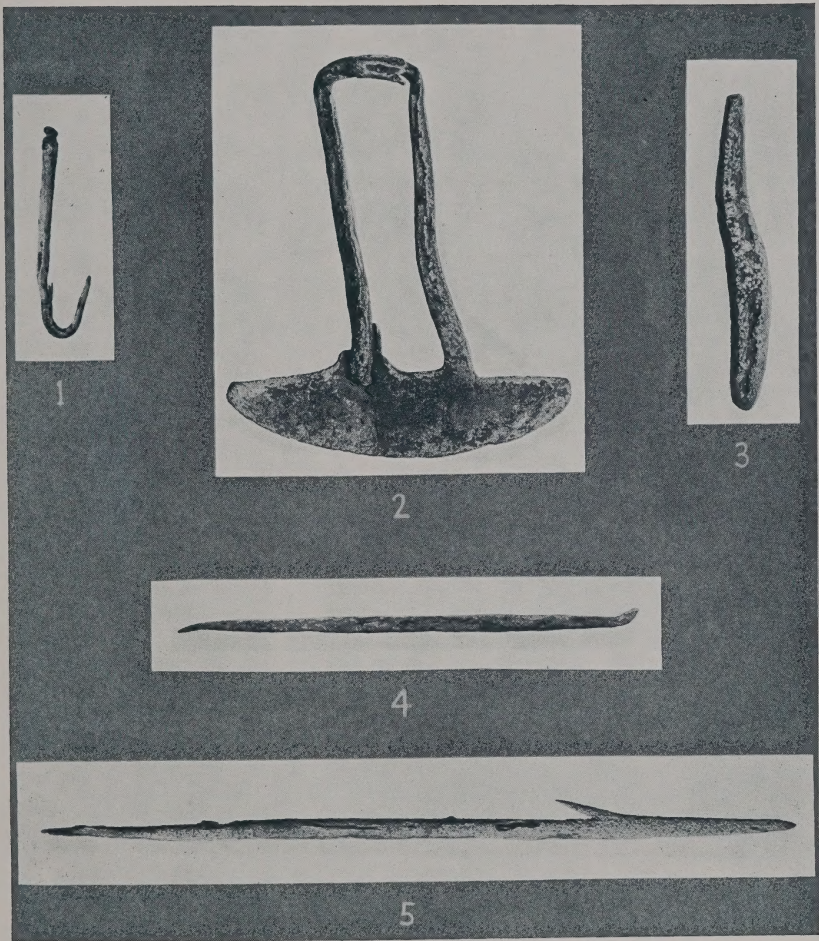
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EXPLANATION OF PLATE LXIII.

- Figure 1. A grooved copper fish-hook found at the junction of the Wolf and Fox rivers, Winnebago County, Wisconsin. Neg. No. 407975.
- Figure 2. Copper crescent from Winnebago County, Wisconsin. Neg. No. 408251.
- Figure 3. An unclassified copper implement found on the shore of Lake Koshkonong, Wisconsin. Neg. No. 407950.
- Figure 4. A possible surgical instrument of copper from Winnebago County, Wisconsin. Neg. No. 408253.
- Figure 5. A copper harpoon from Oshkosh, Winnebago County, Wisconsin. Neg. No. 70108A.

EXPLANATION OF PLATE LXXIII.

- Figure 1. A grooved copper fish-hook found at the junction of the Wolf and Fox rivers, Winnebago County, Wisconsin. Neg. No. 407975.
- Figure 2. Copper crescent from Waupaca County, Wisconsin. Neg. No. 408251.
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- Figure 4. A possible surgical instrument of copper from Waupaca County, Wisconsin. Neg. No. 408253.
- Figure 5. A copper harpoon from Oldenburg, Waupaca County, Wisconsin. Neg. No. 70198A.



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